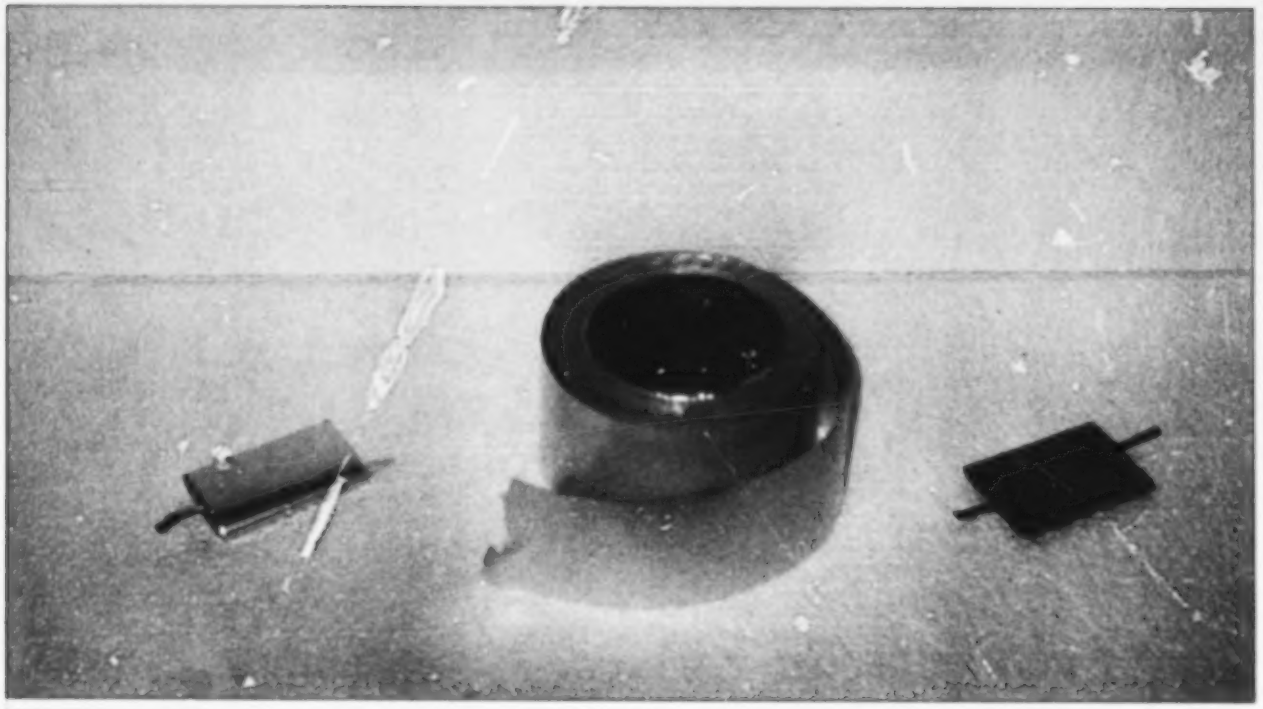
M 581/990

ANNUAL REPORT



MICA

By Lawrence L. Davis

1990

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

I 28.37/2:

READEX FICHE best copy available

MICA

U.S.
DEPARTMENT
OF THE
INTERIOR

Manuel Lujan, Jr.
Secretary

BUREAU
OF
MINES

T S Ary
Director

September 1991

Contents

Domestic Data Coverage 1
Background 1
  Definitions, Grades, and Specifications 1
  Industry Structure 2
  Geology-Resources 2
Annual Review 2
  Legislation and Government Programs 2
  Strategic Considerations 2
  Production 3
    Scrap and Flake Mica 3
    Ground Mica 3
  Consumption and Uses 3
    Sheet Mica 3
    Built-up Mica 4
    Reconstituted Mica (Mica Paper) 4
    Ground Mica 4
  Stocks 5
  Markets and Prices 5
  Foreign Trade 5
  World Review 8
    India 8
    Indonesia 8
Outlook 9

COVER PHOTO:
Mica paper capacitors are used in high-voltage power supplies or transmitters in sophisticated radar, missile, and satellite systems. They are light weight, radiation-resistant, able to withstand shocks and vibrations, and operate over a wide temperature range.

Tables

Table 1.—Salient Mica Statistics .. 1
Table 2.—Stockpile Goals and Government Inventories for Mica, December 31, 1990 3
Table 3.—Scrap and Flake Mica Sold or Used by Producers in the United States, by State 4
Table 4.—Ground Mica Sold or Used by Producers in the United States, by Method of Grinding 4
Table 5.—Fabrication of Muscovite Block Mica in the United States in 1990, by Quality 5
Table 6.—Consumption and Stocks of Mica Splittings in the United States, by Source 5
Table 7.—Built-up Mica Sold or Used in the United States, by Product 5
Table 8.—Ground Mica Sold or Used by Producers in the United States, by End Use 6
Table 9.—Average Reported Price for Dry- and Wet-Ground Mica Sold or Used by U.S. Producers in 1990 6
Table 10.—U.S. Exports of Crude and Rifted Mica, Mica Powder, and Mica Waste in 1990, by Country 6
Table 11.—U.S. Exports of Worked Mica in 1990, by Country 7
Table 12.—U.S. Imports for Consumption of Crude and Rifted Mica in 1990, by Country 7
Table 13.—U.S. Imports for Consumption of Mica Powder and Waste in 1990, by Country 8
Table 14.—U.S. Imports for Consumption of Worked Mica in 1990, by Country 8
Table 15.—Summation of U.S. Mica Trade Data 8
Table 16.—Mica: World Production, by Country 9

For comments or further information, please contact
The Branch of Industrial Minerals
The Division of Mineral Commodities
U.S. Bureau of Mines
2401 E St., NW, MS 5209
Washington, DC 20241-0001
Telephone: (202) 634-1206
Fax: (202) 634-4091

MICA

By Lawrence L. Davis

Mr. Davis, a physical scientist with 35 years of industry and U.S. Bureau of Mines experience, has been the commodity specialist for mica since 1983. Domestic survey data were prepared by Linder Roberts, mineral data assistant; and international data tables were prepared by Audrey Wilkes, international data coordinator.

In 1990, about 109,000 metric tons of scrap and flake mica was produced in the United States, a decrease of 8% from 1989 production. Ground mica sales were 97,000 tons valued at $22 million, a decrease in tonnage of about 4%.

Almost all sheet mica supply continued to be imported. Consumption of muscovite block mica decreased 20% to 6.0 tons. Consumption of mica splittings decreased 24% to 842 tons. The value of sheet mica exports increased 5% to $7.8 million. The value of imports for consumption of sheet mica increased 8% to $9.5 million.

TABLE 1

SALIENT MICA STATISTICS

		1986	1987	1988	1989	1990
United States:						
Production (sold or used by producers):						
Scrap and flake mica	thousand metric tons	134	146	130	119	109
Value	thousands	$7,108	$8,201	$6,793	$6,273	$5,841
Ground mica	thousand metric tons	112	113	109	101	97
Value	thousands	$21,872	$22,376	$23,687	$22,443	$21,610
Consumption:						
Block, muscovite	metric tons	23	26	14	7	6
Value	thousands	$755	$982	$628	$599	$554
Splittings	metric tons	1,010	960	1,104	1,108	842
Value	thousands	$1,252	$1,417	$1,544	$1,703	$1,414
Exports	metric tons	7,685	5,828	7,168	5,327	5,659
Imports	do.	11,761	11,450	14,478	15,834	15,876
World: Production	do.	r274,030	r276,342	r251,856	r229,523	e214,560

eEstimated. rRevised.

DOMESTIC DATA COVERAGE

Domestic production and consumption data for mica are developed by the U.S. Bureau of Mines by means of three separate, voluntary surveys and one mandatory survey. Of the 18 operations to which the crude scrap and flake mica production form was sent, 16 operations, or 89%, responded, representing 86% of the production shown in table 1. Of the 17 operations to which the ground mica form was sent, 15 responded, representing 93% of the production in table 1. Of the five canvassed operations to which the mica block and film consumption form was sent, two, or 40%, responded, representing 65% of the consumption shown in table 1. Of the nine canvassed operations to which the mica splittings consumption form was sent, eight operations, or 89%, responded, representing more than 99% of the splittings consumption shown in table 1. Consumption for the nonrespondents was estimated using prior-year production data.

BACKGROUND

Definitions, Grades, and Specifications

Mica is a group name for a number of complex, hydrous potassium silicate minerals with differing chemical compositions and physical properties. Crystals of mica have excellent basal cleavage and split easily into tough, flexible sheets. The important mica minerals are muscovite and phlogopite.

Commercial qualities of sheet mica are relatively free of defects and tough enough to be punched or stamped into specific shapes. Sheet mica is classified as block, film, or splittings. Block mica is not less than 0.018 centimeters thick and has a minimum usable area of 6.45 square centimeters. Film mica is split to specified thicknesses ranging from 0.0030 to 0.010 centimeters. Splittings are sheets with a maximum thickness of 0.0030 centimeters and a minimum usable area of 4.84 square centimeters. Punch mica, which includes circle and washer mica, is low-quality, hand-trimmed mica up to about 5 centimeters in diameter. The American Society for Testing and Materials (ASTM) designates 13 quality groups for sheet mica, based on quantity of visible inclusions and structural imperfections, ranging from black- and red-stained to perfectly clear. ASTM also designates 12 grades based on the maximum usable rectangle. The sizes range from grade 6 (with 6.45 usable square centimeters) to grade OOEE special (with 645 usable square centimeters).[1]

Block and film mica products are small flat pieces of uniformly thin mica cut or stamped to close tolerances into a variety

of shapes and sizes, depending on the use. Shapes can vary from simple circles, squares, or rectangles to very intricate patterns. Fabricators make their own dies to be able to cut the mica into any pattern desired.

Built-up mica, micanite, consists of partly overlapped and irregularly shaped and arranged splittings cemented together with either an organic or inorganic binder. Large sheets of built-up mica are made by alternating layers of splittings and binder. Sheets of any thickness are made by pressing the layers at high temperatures. Built-up mica is sold in large, uncut sheets or is cut or molded to any size and shape specified by the customer. It is often bonded to another material such as fiberglass cloth to form a composite sheet.

Reconstituted mica or mica paper is a paperlike material made by depositing fine flakes of scrap mica as a continuous mat, which is then dried. The mica paper is sometimes impregnated with an organic binder.

Scrap and flake mica is generally of a quality and size that is not suitable for use as sheet mica. Mine scrap varies greatly in quality but usually is a heterogeneous mixture that must be crushed, screened, and washed to yield the scrap mica in usable form. Mine scrap may be the sole product of mining a pegmatite or may be a byproduct of sheet mica production. Bench scrap or shop scrap is the mica discarded during the processing of handcobbed mica into sheet. Factory scrap is the waste that results from cutting and stamping sheet mica into pieces of definite size and shape. Factory scrap is usually the highest grade and quality material. Scrap mica that is recovered from schists and from the beneficiation of kaolin, feldspar, and lithium pegmatites is often referred to as flake.[2]

Industry Structure

The sheet mica industry in the United States is small, consisting of processors and fabricators of imported mica. Worldwide, India dominates the production of muscovite sheet mica. Madagascar is an important producer of phlogopite sheet mica. Sheet mica mining, trimming, and splitting is very labor intensive, and producing countries have the advantage of low wages and a large labor force that is usually trained at an early age. India's sheet mica industry is characterized by a large number of small operations, most of which sell to larger companies or the Government's Mica Trading Corp. of India Ltd. (MITCO) for further processing and export. India is putting more emphasis on exporting fabricated mica products. This is expected to reduce further the amount of mica that will be fabricated in the United States.

The U.S. flake mica industry ranks first in world production. Most production comes from surface mining of mica schists and as a byproduct of kaolin, feldspar, and lithium beneficiation. Nearly all flake mica is ground to final specifications depending on the use. Other countries producing significant amounts of flake mica are Canada, China, India, the Republic of Korea, and the U.S.S.R. Many other countries produce small amounts.

Geology-Resources

Sheet muscovite is obtained from coarse-grained igneous rocks called pegmatites. Pegmatites also contain quartz, feldspar, and various accessory minerals. Pegmatite dikes and veins range from 1 kilometer or more long and 100 meters wide to thin veins and veinlets of 2 centimeters or so in width.

The United States has no reserves of sheet mica. Small U.S. reserves were extensively worked in the past, and the high cost of labor has kept the mines shut down since the Government's purchase program ended in 1962. The primary sheet mica resources are in New England, the southeastern Piedmont from Virginia to Alabama, the Blue Ridge Mountains in North Carolina, the Black Hills of South Dakota, and northern New Mexico. Other States with some sheet mica resources are California, Colorado, Idaho, Montana, and Wyoming.

No formal evaluation of world resources of sheet mica has been made, mainly because of the sporadic occurrence of this mineral. The most productive sheet mica districts in the world are in the States of Bihar, Andhra Pradesh, and Rajasthan in India. India's large reserves and resources of sheet mica have been the primary world sources for many years. Large reserves of sheet mica also are found in Brazil and western Africa. In the U.S.S.R., sheet mica reserves are known in the Lake Baikal and Sayan upland areas as well as in the South Eniessy Range. Smaller but substantial reserves occur in Argentina, Australia, and Zimbabwe.

Phlogopite deposits are in areas of metamorphosed sedimentary rocks intruded by masses of pegmatite-rich granitic rocks. The phlogopite is found as veins or pockets in pyroxenite interlayered with or intersecting marble or gneiss. Canada and Madagascar have the world's major reserves of phlogopite. Additional reserves are known in the Sludyanka River district and Alden area of the U.S.S.R., Sri Lanka, and Mexico.

The primary domestic source of flake mica for grinding purposes is weathered alaskite bodies and pegmatites in North Carolina, where most domestic flake mica is produced. The mica is recovered as a coproduct of feldspar and kaolin beneficiation. Flake mica is also recovered from muscovite schists. These schists bodies range in size from 3 to more than 100 meters thick and several kilometers long. The mica content ranges up to 90%. Another form of flake mica is fine-grained muscovite called sericite, which is an alteration product of various aluminosilicate minerals.

World reserves and resources of scrap and flake mica are not well known but are considered to be very large. All countries with sheet mica reserves or resources have even larger quantities of scrap mica because only a small fraction of the mica present is of sheet quality. Many other countries have reserves or resources of mica that, while not of sheet quality, are suitable for grinding.

ANNUAL REVIEW

Legislation and Government Programs

The Government inventory of stockpile-grade mica remained about the same at 10,000 tons. The U.S. Department of Defense sold 25 tons of muscovite splittings, 5 tons of phlogopite splittings, and 2 tons of muscovite block, stained and better.

Strategic Considerations

Sheet mica and high-quality scrap mica used for making mica paper are important in the electronic and electrical industries. The United States is not self-sufficient in these materials and imports all its supplies, mostly from India. The U.S.S.R. and other countries with centrally planned economies are currently India's largest customers. The United

TABLE 2

STOCKPILE GOALS AND GOVERNMENT INVENTORIES FOR MICA, DECEMBER 31, 1990

(Metric tons)

Material	Inventory				
	Goal	Stockpile grade	Non-stockpile grade	Available for disposal	1990 sales
Block:					
Muscovite, stained and better	1,134	2,268	94	154	2
Phlogopite	95	8	52	—	—
Film: Muscovite, 1st and 2d qualities	41	533	(1)	468	—
Splittings:					
Muscovite	5,728	6,501	—	315	25
Phlogopite	422	676	—	254	5

[1]Less than 1/2 unit.

States and other market economy countries compete for the remaining mica, and availability is sometimes limited, particularly for high-quality mica. Long delivery times and quality inconsistency also adversely affect sheet mica availability.

In a short-supply situation during an emergency, the National Defense Stockpile (NDS) would be able to meet short-term demand until substitutes could be made available. It is unlikely that domestic sheet mica production could replace or significantly reduce imports. Of the five strategic stockpile categories, only muscovite block mica has ever been produced domestically in significant quantities, and then only under the stimulus of above-market prices paid by the Government. Domestic production in this century never provided more than a small fraction of domestic requirements.

The domestic supply of flake mica is adequate. Scrap and flake mica are not considered to be strategic materials. The United States is self-sufficient in flake mica, but does rely on imports of high-quality scrap for the manufacture of mica paper.

Production

Scrap and Flake Mica.—North Carolina remained the major producing State, with 60% of the total production. The remainder was produced in Connecticut, Georgia, New Mexico, Pennsylvania, South Carolina, and South Dakota. Most mica was recovered from mica schist, high-quality sericite schist, and as a byproduct of kaolin, feldspar, and lithium beneficiation.[3] The five largest producers were, in alphabetical order; The Feldspar Corp., Spruce Pine, NC; Franklin Mineral Products, division of Mearl Corp., Hartwell, GA; KMG Minerals Inc., Kings Mountain, NC; Lithium Corp. of America, Gastonia, NC; and Unimin Corp., Spruce Pine, NC. These five companies produced 67% of the national total.

Falconbridge Ltd., of Toronto, sold its Indusmin Div., which includes a mica mine at Spruce Pine, NC, to Unimin. The operation was subsequently acquired from Unimin by Hecla Mining Co. of Coeur d' Alene, ID.

Low-quality sericite, used primarily in brick manufacturing, is excluded from tabulated data contained in this report. In 1990, four companies, one in North Carolina and three in South Carolina, mined 23,000 tons of low-quality sericite and reported an average value of $3.83 per ton.

Ground Mica.—Eleven companies operated 14 grinding plants in 6 States. Ten plants produced dry-ground and four produced wet-ground mica. The dry-ground mica plants of Deneen Mica Co., Micaville, NC, and J. M. Huber Corp., Kings Mountain, NC, were inactive during the year as was the wet-ground plant of Concord Mica Corp. at Penacook, NH. The five largest producers accounted for 73% of the total. They were, in alphabetical order; KMG Minerals, Kings Mountain, NC; MICA-A Franklin Limestone Co., Santa Fe, NM; Spartan Minerals Corp., Pacolet, SC; Unimin, Spruce Pine, NC; and USG Corp., Spruce Pine, NC.

Several operations changed hands or were put up for sale during the year. Mineral Mining Corp.'s mica mine and grinding plant near Kershaw, SC, were purchased by Piedmont Mining Co. Inc. of Charlotte, NC. The operation, now a wholly owned subsidiary, was renamed Mineral Mining Co. Inc. Mineral Industrial Commodities of America Inc., Santa Fe, NM, was purchased by Franklin Industries, Nashville, TN. The mine and plant now operate as MICA-A Franklin Limestone. J. M. Huber announced plans to sell its mica operations at Kings Mountain and Spruce Pine, NC. At yearend, the facilities were still for sale.

Consumption and Uses

Sheet Mica.—Sheet mica is used principally in the electronic and electrical industries. Its usefulness in these applications stems from its unique electrical and thermal insulating properties and its mechanical properties, which allow it to be cut, punched, or stamped to close tolerances.

The largest use of block mica is as an electrical insulator in electronic equipment. High-quality block mica is also used to line the gauge glasses of high-pressure steam boilers. Transparency, flexibility, and resistance to heat and chemical attack are the properties that make mica suitable for this use. Other uses include diaphragms for oxygen-breathing equipment, marker dials for navigation compasses, optical filters, retardation plates in helium-neon lasers, pyrometers, thermal regulators, and stove windows.

Muscovite film mica is used as a dielectric in capacitors. Only high-quality mica, at or near the top of the quality scale, is used. The highest quality goes into capacitors that are to be used as standards. The next highest qualities are used for transmitting capacitors. Receiving capacitors use slightly lower quality film.

Consumption of muscovite block (ruby and nonruby) totaled 6.0 tons, a 20% decrease from that of 1989. Consumption of stained and lower-than-stained quality decreased 21%, but remained in greatest demand, accounting for 86% of consumption. About one-half of the muscovite consumed was grade No. 5 or smaller. The decrease in consumption

TABLE 3

SCRAP AND FLAKE MICA[1] SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE

(Thousand metric tons and thousand dollars)

State	Quantity	Value
1986	134	7,108
1987	146	8,201
1988	130	6,793
1989	119	6,273
1990:		
North Carolina	65	3,796
Other States[2]	44	2,045
Total	109	5,841

[1]Includes finely divided mica recovered from mica schist and high-quality sericite schist, and mica that is a byproduct of feldspar, kaolin, and lithium beneficiation.
[2]Includes Connnecticut, Georgia, New Mexico, Pennsylvania, South Carolina, and South Dakota.

TABLE 4

GROUND MICA SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY METHOD OF GRINDING[1]

(Thousand metric tons and thousand dollars)

Year	Dry-ground		Wet-ground		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1986	99	14,682	13	7,190	112	21,872
1987	101	15,140	12	7,237	113	[2]22,376
1988	95	14,570	14	9,117	109	23,687
1989	88	13,409	13	9,034	101	22,443
1990	W	W	W	W	97	21,610

W Withheld to avoid disclosing company proprietary data.
[1]Domestic and some imported scrap. Low-quality sericite is not included.
[2]Data do not add to total shown because of independent rounding.

was a continuation of a long-term decrease in block mica use. Five companies continued to consume muscovite block and film in five plants in four States: two in North Carolina and one each in New Jersey, Ohio, and Virginia.

Splittings represent the largest part of the sheet mica industry in the United States. Muscovite and phlogopite splittings are used to make built-up mica. Consumption of mica splittings decreased 24% to 842 tons. Muscovite splittings from India accounted for nearly all of the consumption. The remainder was phlogopite splittings from Madagascar. The splittings were fabricated into various built-up mica products by nine companies operating nine plants in seven States.

Built-up Mica.—The primary use of this mica-base product, made by mechanical or hand setting of overlapping splittings and alternate layers of binders and splittings, was as electrical insulation material. Principal built-up mica products are segment plate, molding plate, flexible plate, heater plate, and tape.

Segment plate acts as insulation between the copper commutator segments of direct-current universal motors and generators. Phlogopite built-up mica is preferred because it will wear at the same rate as the copper segments. Muscovite has a greater resistance to wear, causing uneven ridges that may interfere with the operation of the generator.

Molding plate is sheet from which V-rings are cut and stamped for use in insulating the copper segments from the steel shaft at the ends of a commutator. Molding plate is also fabricated into tubes and rings for insulation in transformers, armatures, and motor starters.

Flexible plate is used in electric motor and generator armatures, field coil insulation, and magnet and commutator core insulation. Heater plate is used where high-temperature insulation is required.

Some types of built-up mica have the bonded splittings reinforced with special paper, silk, linen, muslin, glass cloth, or plastic. These products are very flexible and are produced in wide, continuous sheets that either are shipped in rolls or cut into ribbons, tapes, or any desired dimensions.

Total production, sold or used, of built-up mica decreased 13% from that of 1989. Molding plates and segment plates were the major end products, accounting, respectively, for 35% and 33% of the total. Other end products included flexible plates, heater plates, and tapes.

Reconstituted Mica (Mica Paper).—Primary end uses for mica paper are the same as those for built-up mica. Three companies consumed scrap mica to produce mica paper. The principal source of this scrap mica was India. Manufacturing companies in 1990 were Corona Films Inc., West Townsend, MA; General Electric Co., Coshocton, OH; and US Samica Corp., Rutland, VT.

Ground Mica.—The largest domestic use of ground mica was in gypsum plasterboard joint cement. The mica acts as a filler and extender, provides a smooth consistency, improves the workability of the cement, and imparts resistance to cracking.

In the paint industry, ground mica is used as a pigment extender that also facilitates suspension, reduces checking and chalking, prevents shrinking and shearing of the paint film, increases resistance of the paint film to water penetration and weathering, and brightens the tone of colored pigments.

Ground mica is used in the well drilling industry as an additive to drilling muds. The coarsely ground mica flakes help prevent lost circulation by sealing porous sections of the drill hole.

The rubber industry uses ground mica as an inert filler and as a mold lubricant in the manufacture of molded rubber products such as tires. The plastics

TABLE 5

FABRICATION OF MUSCOVITE BLOCK MICA IN THE UNITED STATES IN 1990, BY QUALITY

(Kilograms)

Quality	1989	1990
Good stained or better	886	817
Stained or lower[1]	6,595	5,193
Total	7,481	6,010

[1]Includes punch mica.

TABLE 6

CONSUMPTION AND STOCKS OF MICA SPLITTINGS IN THE UNITED STATES, BY SOURCE

	India		Madagascar		Total[1]	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Consumption:						
1986	r996	$1,136	13	$116	1,010	$1,252
1987	930	1,231	30	185	960	1,417
1988	1,069	r1,338	30	206	1,104	1,544
1989	1,062	1,448	46	255	1,108	1,703
1990	W	W	W	W	842	1,414
Stocks on Dec. 31:						
1986	566	NA	43	NA	610	NA
1987	408	NA	4	NA	412	NA
1988	439	NA	5	NA	444	NA
1989	496	NA	9	NA	505	NA
1990	W	NA	W	NA	632	NA

[r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.
[1]Data may not add to totals shown because of independent rounding.

TABLE 7

BUILT-UP MICA[1] SOLD OR USED IN THE UNITED STATES, BY PRODUCT

Product	1989		1990	
	Quantity (metric tons)	Value (thousand)	Quantity (metric tons)	Value (thousand)
Flexible (cold)	85	$545	96	$588
Heater plate	18	74	W	W
Molding plate	316	1,011	291	1,623
Segment plate	378	2,216	284	1,777
Tape	51	277	W	W
Other	141	1,607	190	2,223
Total	[2]990	5,730	861	6,211

W Withheld to avoid disclosing company proprietary data. Included in "Other."
[1]Consists of alternating layers of binder and irregularly arranged and partly overlapped splittings.
[2]Data do not add to total shown because of independent rounding.

industry uses ground mica as an extender and also as a reinforcing agent.

Ground mica is used in the production of rolled roofing and asphalt shingles, where it serves as an inert filler and surface coating to prevent sticking of adjacent surfaces. The coating is not absorbed by freshly made roofing because mica has a platy structure and is not affected by the acid in the asphalt or by weathering. Other uses include decorative coatings on wallpaper and on concrete, stucco, and tile surfaces; as an ingredient in some special greases; as a coating for cores and molds in metal casting; and as a flux coating on welding rods.

In 1990, the major end uses were joint cement, 55%; paints, 14%; and well-drilling muds, 7%.

Stocks

Reported yearend consumer stocks of sheet mica increased 23% to 668 tons; of this, mica splittings represented 95%, and mica block represented 5%.

Markets and Prices

Prices for sheet mica vary with grade and quality and can range from less than $1 per kilogram for low-quality mica to more than $2,000 per kilogram for the highest quality. The average values of muscovite sheet mica consumed in the United States in 1990 compared with 1989 were as follows: Block increased 15% to $92 per kilogram, and splittings increased 14% to $1.55 per kilogram. The average value of phlogopite block increased 18% to $26 per kilogram, while the value of phlogopite splittings decreased 20% to $4.43 per kilogram. The large changes in average value are more a reflection of the quality of mica consumed during the year than actual changes in price. The average value of crude flake mica, including high-quality sericite, was $54 per ton. The average value per ton for North Carolina flake mica, predominantly a flotation product, was $59.

Foreign Trade

The United States continued to rely on imports, mostly from India, for nearly all of its sheet mica and paper-quality scrap mica. Imports for consumption of unmanufactured block, film, and splittings

TABLE 8

GROUND MICA SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY END USE

(Thousand metric tons and thousand dollars)

End use	1989		1990	
	Quantity	Value	Quantity	Value
Joint cement	58	11,198	53	8,984
Paint	10	1,512	14	2,894
Plastics	3	876	2	675
Well-drilling mud	7	816	7	1,114
Other[1]	23	8,041	21	7,944
Total[2]	101	22,443	97	21,610

[1]Includes mica used for molded electrical insulation, rubber, textile and decorative coatings, welding rods, and miscellaneous.
[2]Data may not add to totals shown because of independent rounding.

TABLE 9

AVERAGE REPORTED PRICE FOR DRY- AND WET-GROUND MICA SOLD OR USED BY U.S. PRODUCERS IN 1990

(Dollars per metric ton)

Kind	Price
Wet-ground	663
Dry-ground	151
End uses:	
Joint cement	168
Paint	212
Plastics	288
Well-drilling mud	162
Other[1]	381

[1]Includes mica used for molded electrical insulation, roofing, rubber, textile and decorative coating, welding rods, and miscellaneous.

TABLE 10

U.S. EXPORTS OF CRUDE AND RIFTED MICA, MICA POWDER, AND MICA WASTE IN 1990, BY COUNTRY

Country	Crude and rifted				Powder		Waste	
	Less than $0.55 per kilogram		More than $0.55 per kilogram					
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	—	—	15	$35	32	$17	—	—
Barbados	15	$5	—	—	18	14	—	—
Belgium	60	28	—	—	230	97	—	—
Brazil	18	10	—	—	38	32	—	—
Canada	98	31	—	—	2,152	777	11	$3
China	—	—	48	75	—	—	—	—
Colombia	—	—	7	15	103	34	—	—
France	9	3	—	—	110	35	—	—
Germany, Federal Republic of	—	—	1	11	189	51	—	—
Italy	—	—	2	12	64	34	—	—
Japan	116	41	72	77	288	157	—	—
Korea, Republic of	—	—	3	21	459	283	—	—
Mexico	39	14	1	19	124	113	—	—
Norway	48	17	—	—	—	—	—	—
Philippines	8	3	—	—	30	22	—	—
Sweden	—	—	—	—	73	45	—	—
Taiwan	—	—	—	—	114	109	—	—
Thailand	—	—	—	—	32	56	—	—
United Kingdom	—	—	1	7	18	56	—	—
Venezuela	—	—	—	—	11	12	141	485
Other[1]	12	4	—	—	235	104	5	3
Total[2]	424	155	148	272	4,319	2,050	156	491

[1]Includes the Bahamas, Chile, Ecuador, Hong Kong, Indonesia, Ireland, Israel, Malaysia, the Netherlands, Pakistan, Peru, Saudi Arabia, and Singapore.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 11

U.S. EXPORTS OF WORKED MICA, BY COUNTRY

Country	Plates, sheets		Other	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	45	$334	—	—
Austria	19	120	—	—
Bahamas	5	13	12	$43
Brazil	51	618	1	12
Canada	231	2,281	48	1,134
France	(1)	8	4	79
Germany, Federal Republic of	1	22	11	51
Italy	33	765	—	—
Japan	(1)	10	1	31
Korea, Republic of	4	38	(1)	7
Mexico	33	572	17	252
Netherlands	2	38	—	—
New Zealand	44	210	—	—
Peru	—	—	2	47
Singapore	(1)	24	2	71
South Africa, Republic of	1	34	3	18
Spain	5	90	—	—
Sweden	2	68	—	—
Taiwan	2	58	8	172
United Kingdom	2	52	(1)	6
Other[2]	13	146	8	142
Total[3]	495	5,502	117	2,065

[1]Less than 1/2 unit.
[2]Includes Anguilla, Antigua, Argentina, Belgium, Chile, Colombia, Costa Rica, the Dominican Republic, Guatemala, Hong Kong, Indonesia, Ireland, the Netherland Antilles, Panama, the Philippines, Saudi Arabia, Switzerland, Turks and Caicos Islands, and Venezuela.
[3]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 12

U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND RIFTED MICA IN 1990, BY COUNTRY

Country	Split block		Splittings		Other			
					Less than $0.55 per kilogram		More than $0.55 per kilogram	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Brazil	—	—	—	—	20	$8	—	—
France	1	$39	(1)	$9	—	—	—	—
India	379	325	1,184	1,321	3,809	856	14	$181
Japan	—	—	—	—	—	—	12	64
Madagascar	—	—	20	88	—	—	—	—
Other[2]	—	—	—	—	—	—	4	23
Total[3]	381	364	1,204	1,419	3,829	864	30	268

[1]Less than 1/2 unit.
[2]Includes Canada and China.
[3]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 13

U.S. IMPORTS FOR CONSUMPTION OF MICA POWDER AND WASTE IN 1990, BY COUNTRY

Country	1989		1990	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Canada	8,591	$3,594	2	$2
India	64	11	202	108
Japan	146	1,289	1	13
Norway	268	92	—	—
Other[1]	73	147	—	—
Total	9,142	5,133	205	123

[1]Includes China, France, Mexico, Switzerland, and the United Kingdom.

Source: Bureau of the Census.

TABLE 14

U.S. IMPORTS FOR CONSUMPTION OF WORKED MICA IN 1990, BY COUNTRY

Country	Plates, sheets		Other	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Austria	2	$48	18	$462
Belgium	645	4,442	9	46
Brazil	41	160	76	220
China	26	65	—	—
India	28	288	129	842
Korea, Republic of	1	5	25	56
Other[1]	42	358	43	440
Total	785	[2]5,365	300	2,066

[1]Includes Canada, Denmark, France, the Federal Republic of Germany, Hong Kong, Italy, Japan, Madagascar, Mexico, Spain, Suriname, Switzerland, and the United Kingdom.

[2]Data do not add to total shown because of independent rounding.

Source: Bureau of the Census.

were about 1,600 tons, about the same as in 1988 and 1989, but considerably higher than in previous years. The high level of imports is a result of lower than average sales of mica from the NDS and continued decrease in domestic fabrication of mica parts. Worked mica imports remained at about 1,100 tons. About 9,000 tons of ground mica was imported, mostly from Canada, while about 4,000 tons was exported to 30 countries. The combined value of all mica imports increased 4% to $15.6 million, while the combined value of all mica exports increased 10% to $10.5 million.

World Review

World production of mica decreased 7% to 215,000 tons. The United States continued to lead in the production of flake mica. India continued to lead in the production of sheet mica.

India.—The Engineering Export Promotion Council (EEPC), which monitors and promotes the export of manufactured mica products, asked the Government of India to rescind the 3.5% levy on mica exports. EEPC felt that the tax, in effect since 1946, adversely affects the competitiveness of India's mica exports.[4]

Indonesia.—A deposit, reportedly containing about 90 million tons of mica, was discovered near Wasior in north central Irian Jaya.[5]

TABLE 15

SUMMATION OF U.S. MICA TRADE DATA

	Scrap and flake mica				Sheet mica			
	Powder		Waste		Unworked		Worked	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Exports:								
1986	5,300	$1,758	1,454	$472	44	$196	[e]887	$4,502
1987	4,235	1,275	824	259	77	145	[e]692	4,748
1988	5,202	1,623	1,088	367	63	228	[e]815	6,148
1989	3,628	1,634	1,224	555	60	156	415	7,227
1990	4,319	2,050	580	646	148	272	612	7,568
Imports for consumption:								
1986	5,450	2,324	4,510	1,225	846	653	955	4,859
1987	5,672	2,685	3,916	1,243	1,116	1,230	746	5,125
1988	7,778	4,222	4,345	1,339	1,603	2,083	751	5,679
1989	8,902	4,971	4,185	1,256	1,616	2,054	1,129	6,711
1990	9,142	5,133	4,034	987	1,615	2,051	1,085	7,431

[e]Estimated.

Source: Bureau of the Census.

TABLE 16

MICA: WORLD PRODUCTION, BY COUNTRY[1]

(Metric tons)

Country[2]	1986	1987	1988	1989	1990[e]
Argentina:					
Sheet	234	340	330	r,e400	400
Waste, scrap, etc.	317	451	630	e500	500
Brazil	2,060	r2,415	2,520	r2,579	2,500
Canada[e]	12,000	13,500	12,000	12,000	12,000
France	10,834	r9,300	r,e9,000	r,e9,000	9,000
India:					
Crude	4,746	4,240	3,839	4,186	4,200
Scrap and waste	2,773	6,307	3,694	3,121	3,100
Total	r7,519	r10,547	r7,533	r7,307	7,300
Iran[3]	r2,450	r1,127	r2,294	r,e2,000	2,000
Korea, Republic of (all grades)	41,997	31,938	r18,848	r7,888	8,000
Madagascar (phlogopite)	1,594	402	r618	r1,068	1,000
Mexico (all grades)	1,748	3,419	r6,228	r4,510	5,400
Morocco[e]	1,500	1,500	1,500	1,500	1,500
Mozambique[e]	300	(4)	(4)	—	—
Namibia	—	—	—	r(5)	—
Peru[e]	550	550	550	500	500
South Africa, Republic of (scrap)	2,509	970	1,669	r1,708	6,1,765
Spain	325	r370	e300	r,e350	300
Sri Lanka	r895	r1,228	r1,981	r2,510	2,400
Sudan (all grades)[e]	10	r5	r(5)	(5)	—
Taiwan	r774	787	4,387	4,290	4,000
Tanzania (sheet)	(4)	(4)	(4)	(4)	(4)
U.S.S.R. (all grades)[e]	50,000	50,000	50,000	50,000	45,000
United States (scrap and flake)[7]	r134,400	145,650	129,900	119,142	6108,845
Yugoslavia	r674	1,043	768	e800	750
Zimbabwe	r1,340	800	e800	r1,471	1,400
Total	r274,030	r276,342	r251,856	r229,523	214,560

[e]Estimated. [r]Revised.
[1]Table includes data available through May 24, 1991.
[2]In addition to the countries listed, China, Norway, Pakistan, Romania, and Sweden are known to produce mica, but available information is inadequate to make reliable estimates of output levels.
[3]Data are for year beginning March 21 of that stated.
[4]Less than 1/2 unit.
[5]Revised to zero.
[6]Reported figure.
[7]Excludes U.S. production of low-quality sericite and sheet mica, if any.

OUTLOOK

Demand for sheet mica has decreased dramatically during the past 30 years. For block and film mica, the major cause of decreased demand was technological change, specifically the introduction of semiconductor technology in electronics to the detriment of vacuum tube electronics that used large quantities of mica. Although the major impact of the technology change was felt in the 1960's and 1970's, consumption of block and film mica continues to decrease, albeit more slowly. Substitute materials cause part of the decrease, and increased imports of finished electronic gear mean fewer mica parts are fabricated in the United States. Since 1979, consumption block mica has decreased at an average annual rate of about 20%. This decline is expected to continue, and, by 1995, consumption will decrease to 2,500 kilograms. Consumption of mica splittings, the major type of sheet mica consumed in the United States, also decreased sharply through the 1960's and 1970's. During the 1980's, consumption leveled off to between 900 and 1,000 tons per year. Decreases were due to the development of substitute electrical insulating materials, miniaturization of electrical equipment, and increased imports of foreign-built products. Consumption of splittings is expected to decrease very slightly in the near future, remaining between 800 and 1,000 tons through 1995.

Scrap and flake mica enters markets as ground mica, and demand tends to follow construction activity levels. With construction activity somewhat depressed, ground mica consumption has decreased to about 100,000 tons for the past 3 years, down about 15% compared with the 1985-87 levels. Recessionary pressures are expected to ease in the near future, allowing modest increases in construction activity, which will probably bring ground mica consumption to about 120,000 tons by 1995.

The major end use, as a filler in joint compounds, will continue to account for 55% to 60% of the market. Consumption for other uses—in paints, well-drilling muds, and plastics—is expected to increase slightly by 1995.

[1] American Society for Testing and Materials. Standard Specification for Natural Muscovite Block Mica and Thins Based on Visual Quality. D351-7. (1977) in 1984 Annual Book of ASTM Standards: Volume 10.01, Electrical Insulation—Specifications: Solids, Liquids, and Gases; Test Methods: Liquids and Gases; Electrical Protective Equipment for Workers. Philadelphia, PA, 1984, pp. 136–143.
[2] Skow, M. L. Mica—A Materials Survey. BuMines IC 8125, 1962, 240 pp.
[3] Production of high-quality sericite is included in the totals; however, figures for low-quality sericite, used principally for brick manufacturing, are not included.
[4] U.S. Embassy, New Delhi, India. State Dep. Telegram 11672, May 21, 1990, p. 4.
[5] Mining Journal (London). V. 314, No. 8076, June 22, 1990, p. 492.

OTHER SOURCES OF INFORMATION

Bureau of Mines Publications

Mica. Ch. in Minerals Yearbook, annual.
Mica. Ch. in Mineral Commodity Summaries, annual.
Mica. Ch. in Bulletin 675, Mineral Facts and Problems, 1985 edition.

Other Sources

Engineering and Mining Journal.
Industrial Minerals (London).
Industrial Minerals and Rocks, 5th ed., AIME, 1983.
Mining Engineering.
The Economics of Mica 1989, Roskill Information Services Ltd.
The Mica Industry Association.

☆ U.S. Government Printing Office : 1991 -281-983/40076